AGRICULTURAL ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF THE GROMIS-NAMA-AGGENEIS 400 KV IPP INTEGRATION

PREPARED FOR

ENVIROWORKS

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EXECUTIVE SUMMARY

Digital Soil Africa was tasked with the Agricultural Assessment for the proposed development of the Gromis-Nama-Aggeneis 400 kv IPP integration.

The previous scoping report; Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa (CSIR, 2016) indicated that the study area was predominately low sensitivity for agricultural sensitivity. The desktop study also confirmed these results.

During the fieldwork four alternatives were investigated, of which the first alternative followed the existing powerline. During the fieldwork, intensive and collaborative meetings were held with the specialists and Eskom officials and from these discussions it was decided to focus on Alternative 1, 2 and a 5th alternative was added.

A novel soil mapping technique, using the DSMART algorithm (Odgers et al., 2014), was used to produce the soil map. Soil observations were made throughout the study area during the fieldwork to collect data for the mapping purposes. The resulting soil map was used to interpret the agricultural sensitivity.

The area has a very low rating, with some existing agricultural lands in the more mountainous terrain.

Due to the low rainfall and high temperatures, the agricultural potential is severely impacted and limited by climate. The low rainfall and high temperatures are the main control on irrigation practices in the survey area and not soil suitability. Cropped lands are sparsely distributed in the more mountainous areas, and the flats are solely used for grazing. Even were crops are grown, these would be considered marginal areas and low yields are expected. No irrigation or special crops were encountered during the fieldwork, which correlates with the latest Landuse maps.

Although the presence of powerlines will not heavy affect the agricultural potential of any of the routes, the use of existing roads will be most beneficial. Therefore, all routes are suitable for the development of a new power line from Gromis substation via Nama substation towards Aggeneis substation. Nonetheless, to utilize the existing road network it is the recommendation that Alternative 1 is used, and since Alternative 5 is very similar it would also utilize most of the existing road network.

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Figure A: Sensitivity rating and the routes investigated

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SPECIALIST CV

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EDUCATION

PhD Soil Science	University of the Free State	2018
M.Sc. Soil Science	University of the Free State	2013
B.Sc. Soil Science (Hon)	University of the Free State	2009
B.Sc. Soil Science	University of the Free State	2008
Matric certificate	Queens College	2005

PROFFESSIONAL AFFILIATIONS

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Member of the Soil Science Society of South Africa

Member of the Soil Classification Work Group

Member of South African Soil Surveyors Organisation

WORK EXPERIENCE

Digital Soils Africa / Soil Scientist - May 2012 – Present

Ghent University / Researcher- January 2016 - December 2016

University of the Free State/ Assistant Researcher- January 2011- December 2015

PUBLICATIONS

Bouwer, D., Le Roux, P. A., van Tol, J. J., & van Huyssteen, C. W. (2015). Using ancient and recent soil properties to design a conceptual hydrological response model. Geoderma, 241, 1–11.

Van Zijl, G. M., Bouwer, D., van Tol, J. J., & le Roux, P.A.L. (2014). Functional digital soil mapping: A case study from Namarroi, Mozambique. Geoderma, 219-220, 155–161.

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SPECIALIST DECLARATION

I, Darren Bouwer, declare that –

- I act as the independent specialist in this application;
- regard the information contained in this report to be true and correct;
- I do not have a conflict of interest in this project;
- I will conduct the work relating to the project in an objective manner.

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BACKGROUND TO THE STUDY

Eskom proposes to develop a new power line from Gromis substation via Nama substation towards Aggeneis substation in the Northern Cape Province.

In order to ensure that the Namaqualand network is compliant and that there is sufficient line capacity to accommodate potential Independent Power Producers (IPPs) within the Namaqualand area, the construction of the new Gromis-Nama-Aggeneis 400 kV line and establishment of a 400/132 kV yard at Nama substation is proposed. The Screening Assessment aims to assess possible route alternatives for the proposed new power line.

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR STRATEGIC ELECTRICAL GRID INFRASTRUCTURE CORRIDORS

In 2016 a Strategic Environmental Assessment (SEA) was undertaken by CSIR. The purpose of the SEA was to identify strategic Electricity Grid Infrastructure (EGI) Corridors to support electricity transmission up to 2040. The vision for the Strategic EGI was to expand in an environmentally responsible and efficient manner that effectively meets the country's economic and social development needs.

The final EGI Power Corridors assessed as part of the 2016 EGI Strategic SEA were gazetted for implementation on 16 February 2018 in Government Gazette 41445, Government Notice R.113. One of these corridors, was the Northern Corridor – Please see Figure 1 for the Gazzetted Corridors. The proposed new power line will be constructed within the Northern Corridor.

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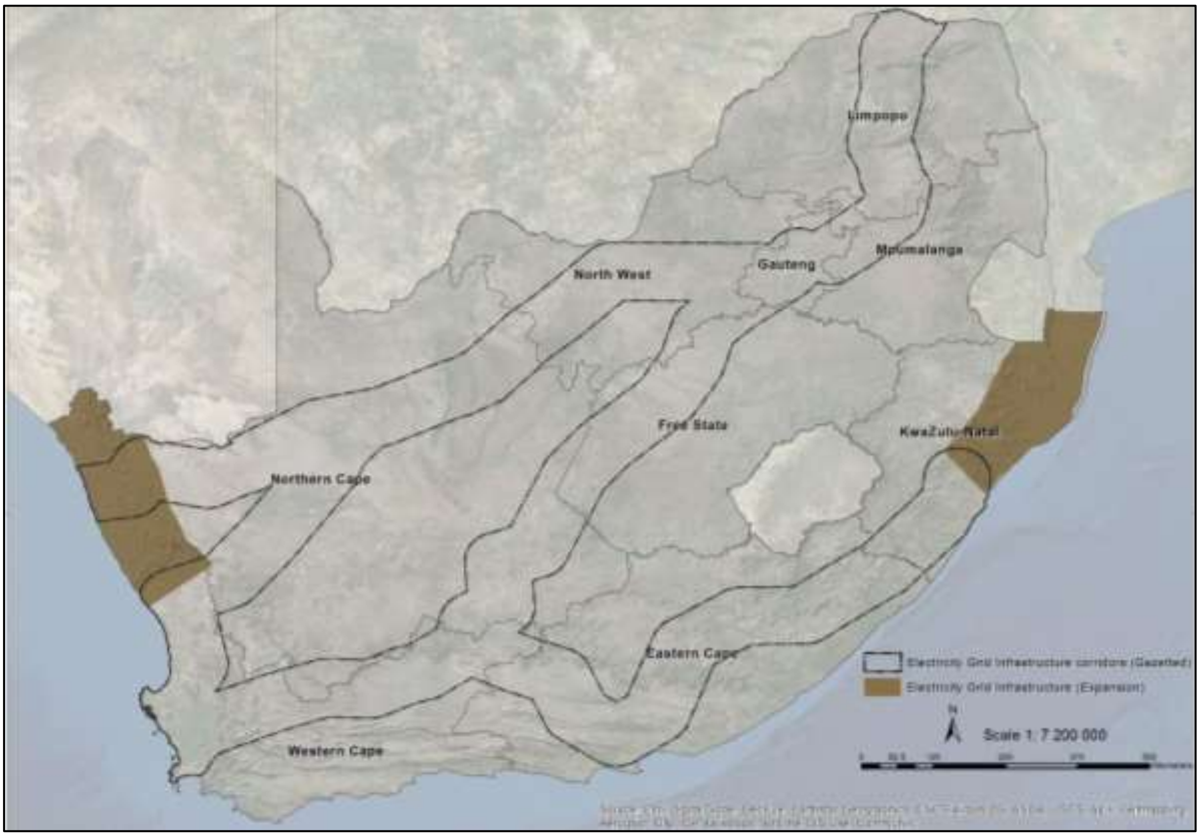

FIGURE 1: THE FINAL ELECTRICITY GRID INFRASTRUCTURE (EGI) POWER CORRIDORS ASSESSED AS PART OF THE 2016 EGI STRATEGIC ENVIRONMENTAL ASSESSMENT

ALTERNATIVE ENVIRONMENTAL AUTHORISATION PROCEDURE TO BE FOLLOWED

The above mentioned Gazette provided an alternative procedure to be followed when applying for Environmental Authorisation for the development of large scale electricity transmission and distribution infrastructure (identified in terms of section 24(2)(a) of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA)) when these activities fall within the identified Strategic Transmission Corridors, such as the Northern Corridor.

The development of large scale electricity transmission infrastructure triggers Listed Activity 9 of Listing Notice 2 of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), which usually would require a full Scoping and Environmental Impact Assessment. However, when such a development is to take place within a Strategic Transmission Corridor, a Basic Assessment (BA) Process in terms of the 2014 EIA Regulations (as amended) is to be followed. This speeds up the Environmental Authorisation process for EGI developments within any of the five Strategic Transmission Corridors. A pre-requisite for the BA process to be

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followed is however the obtaining of a servitude prior to application for environmental authorisation.

One of the objectives of this SEA process was also to provide developers with the flexibility to consider a range of route alternatives within the strategic corridors to avoid land negotiation issues and to submit a pre-negotiated route to the Competent Authority.

As noted above, this has been achieved for the development of EGI within any of the five Strategic Transmission Corridors gazetted in February 2018 (GN 113 in Government Gazette 41445), for which:

(a) a pre-negotiated route must be submitted to the Department of Environmental Affairs (DEA); and,

(b) a BA procedure needs to be followed in compliance with the 2014 EIA Regulations (as amended) instead of a full Scoping and EIA process previously triggered by such activities.

SCREENING OF ALTERNATIVE ROUTES

The purpose of the current Screening Assessment is to evaluate alternative routes within the Northern Corridor. As part of the Screening Assessment, a group of specialists evaluated the alternative routes according to potential sensitive environmental, social and economic issues. The findings of all the specialists will be integrated to make an informed decision on the best route alternative for the proposed power line.

This study will thus be undertaken in terms of Regulation 15 of the Environmental Impact Assessment Regulations, 2014 (Government Notice No. R 982, In the Gazette No. 38282 of 4 December 2014), that provides for the procedure to be followed in applying for environmental authorisation for large scale electricity transmission and distribution development activities identified in terms of section 24(2)(a) of the National Environmental Management Act, 1998.

Enviroworks, a professional Environmental Compliance consultancy, was appointed by Eskom to conduct the screening assessment of the alternative route options. Several specialist studies will be conducted as part of the screening process. These studies include:

- Heritage Impact Assessment
- Socio-Economic Impact Assessment
- Botanical Impact Assessment

- Fauna Impact Assessment
- Avifaunal Impact Assessment
- Visual Impact Assessment
- Agricultural Impact Assessment
- Geohydrological Impact Assessment

The specialist findings will be used to produce a Screening Report that will provide the best route alternative based upon NEMA Principles, the Best Available Technology principle and consultation with stakeholders such as Landowners, Organs of State , NGO's and any other Interested and Affected Parties (I&APs).

The Screening Report will then be used by Eskom to negotiate a servitude with landowners. These negotiations will take place after the Screening Assessment and will not form part of the current study. After negotiations with landowners Eskom will proceed with the next stage which is to conduct a Basic Assessment in order to obtain an Environmental Authorisation from the competent authority for the pre-negotiated route. Stakeholder consultation will be done again during this phase. Ample time will be provided for the public to comment. All information gathered during the screening process will be used in the BA process and application for authorisation.

LOCALITY AND DESCRIPTION ALTERNATIVES

The proposed route alternatives currently being assessed are situated within the Northern Corridor.

NEED AND DESIRABILITY

Electricity Grid Infrastructure (EGI) is required to provide grid access to electricity producers, in order to be able to distribute the electricity they generate to users. Independent Power Producers (IPPs) have rapidly become key electricity producers and this has increased the demand for grid access and hence the need to construct more EGI.

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INTRODUCTION

Agriculture is a large contributor to the economy and food security of South Africa. Notably, approximately 16% of the employment in the Northern Cape is in the Agricultural Sector. The main agricultural products are table grapes, dates, cotton, cereal crops, and livestock farming with goats, sheep, cattle and horses. Therefore, it is extremely important that valuable agricultural land is protected from being developed in an unsustainable way and appropriate soil and land capability assessments must forego all developments.

STUDY AREA DESCRIPTION

There were four routes investigated during the study (Figure 2). Alt 1 was following the existing power line and the other alternatives investigated look at new routes.

FIGURE 2: LOCATION OF ALTERNATIVE ROUTES OF GROMIS-NAMA-AGGENEIS 400 KV IPP INTEGRATION.

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DATA SOURCES

Description	Source
Land capability	AGIS
Land type data	Land Type Survey Staff (1972 – 2002)
SRTM DEM	https://earthexplorer.usgs.gov/
Geology	Council for Geoscience (2007)

ASSESSMENT METHODOLOGY

DESKTOP SURVEY

Environmental covariates were collected for the area surrounding the study site. Secondary covariate layers were derived from the Landsat 8 and DEM layers in SAGA-GIS. Terrain derivative secondary covariate layers.

Secondly, land type information was obtained for the site (Land Type Survey Staff, 1972 – 2002; (Figure 5). A land type is an area with similar climate, geology and soil distribution patterns and therefore gives a good spatial representation of homogenous areas.

The South African Land-Cover 2018 dataset was used and ground proofed for the area.

SOIL MAPPING

Soil profile pits were augured to 1.5 m or to a limiting layer. The soils were classified according to the Soil Classification Working Group (2018). Soil depth, freely drainable depth and limiting material were described. Samples of modal profiles were collected per horizon for analysis of selected chemical and textural properties.

The basic cations were determined from a 1:10 NH_4OAc extract (White 2006) and soil pH was determined with a 1:2.5 KCl extract. The texture was measured using a pipette (Gee and Bauder, 1979). Electrical conductivity (ECe)was measured with the saturated paste extract.

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To create the soil map, the land type inventories were divided into soil mapping units according to the Table 1, and then the percentage occupancy of each map unit calculated. Using the DSMART algorithm (Odgers et al., 2014), 100 samples per polygon and the following environmental covariates were used: Topographic wetness index (TWI), slope, Multi Resolution index of Valley Bottom Flatness (MRVBF), elevation, valley depth and topographic position index (TPI). The resultant map was compared to the observations made to determine the map accuracy.

TABLE 1: MAP CODE AND DESCRIPTION

Map Code	Map unit	Description	Soil Forms (Red book)
1	Deep	Deeper than 1200 mm depth, apedal structure	Hutton, Clovelly, Oakleaf
2	Dundee	Dundee soil form	Dundee
3	Lepto	Shallower than 500mm, apedal structure	Mispah, Glenrosa, Hutton
4	Moderate	Moderate depth, between 500 and 1200 mm, apedal structure	Hutton, Clovelly, Oakleaf
5	Pedo	Soils with pedo- or prismacutanic B horizon	Valsrivier, Swartland, Sterkspruit

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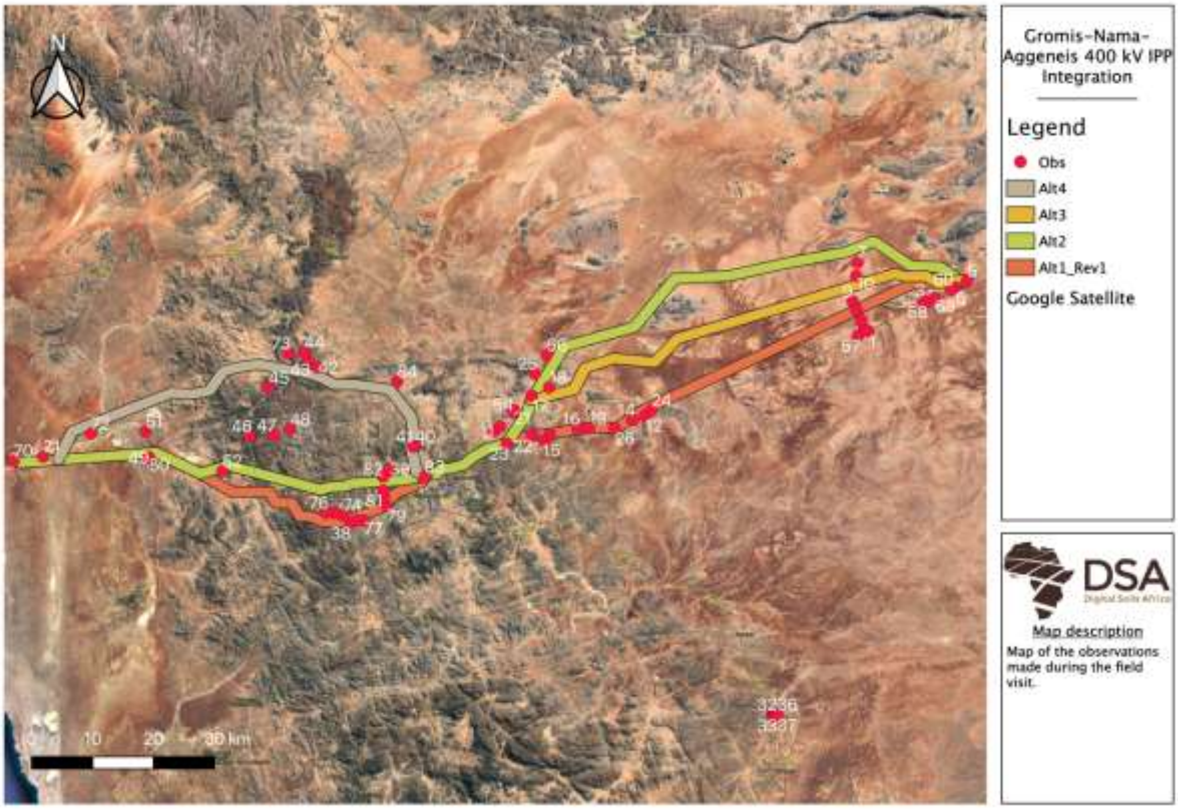

FIGURE 3: OBSERVATIONS MADE DURING FIELD VISIT.

SENSITIVITY RATING

The sensitivity rating for the soils found were used from the previous Agriculture Scoping Assessment Report in the Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa (CSIR, 2016), which prescribed the identification and allocation of sensitivity ratings to all agricultural features and is summarised in Table 2.

TABLE 2: SENSITIVITY CLASSES PROPOSED BY CSIR (2016).

Sensitivity class	Features	Interpretation
Very high	Pivots; horticulture & vines > 400 metres; land capability class I.	Potentially unsuited to development because it will lead to loss of some land with existing high agricultural productivity.
High	Horticulture & vines < 400 metres; timber plantations; land capability class II.	Avoid where possible because it will lead to some disturbance and loss of existing or potential agricultural (or forestry) production.

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Medium	Sugar cane; all other cultivated land; land capability class III.	Re-route onto lower sensitivity agricultural land (where possible and where all other factors are equal) because it will lead to very minor disturbance and loss of existing or potential agricultural production.
Low	All other land	Insignificant impact on agriculture.

The results from the The *National Screening Tool* of the Department of Environmental Affairs (DEA) was used to in the desktop study to help identify areas of sensitivity. Appendix 3 has the results of the screening tool for agricultural sensitivity for the alternative routes.

IMPACT RATING

For each potential impact, the DURATION (time scale), EXTENT (spatial scale), IRREPLACEABLE loss of resources, REVERSIBILITY of the potential impacts, MAGNITUDE of negative or positive impacts, and the PROBABILITY of occurrence of potential impacts must be assessed. The assessment of the above criteria will be used to determine the significance of each impact, with and without the implementation of the proposed mitigation measures. The scales to be used to assess these variables and to define the rating categories are tabulated in Table 3 and Table 4 below.

TABLE 3: EVALUATION COMPONENTS, RANKING SCALES AND DESCRIPTIONS (CRITERIA).

Evaluation component	*Ranking scale and description (criteria)*
DURATION	***5 - Permanent***
	4 - Long term*: Impact ceases after operational phase/life of the activity (> 20 years).*
	3 - Medium term*: Impact might occur during the operational phase/life of the activity (5 to 20 years).*
	2 - Short term*: Impact might occur during the construction phase (< 5 years).*
	1 - Immediate
EXTENT *(or spatial scale/influence of impact)*	***5 - International****: Beyond National boundaries.*
	4 - National*: Beyond Provincial boundaries and within National boundaries.*
	3 - Regional*: Beyond 5 km of the proposed development and within Provincial boundaries.*
	2 - Local*: Within 5 km of the proposed development.*
	1 - Site-specific*: On site or within 100 m of the site boundary.*
	0 *- None*
IRREPLACEABLE loss of resources	***5 – Definite*** *loss of irreplaceable resources.*
	4 – High *potential for loss of irreplaceable resources.*
	3 – Moderate *potential for loss of irreplaceable resources.*

	*2 – **Low** potential for loss of irreplaceable resources.* *1 – **Very low** potential for loss of irreplaceable resources.* *0 - **None***
***REVERSIBILITY** of impact*	*5 – Impact **cannot** be reversed.* *4 – **Low** potential that impact might be reversed.* *3 – **Moderate** potential that impact might be reversed.* *2 – **High** potential that impact might be reversed.* *1 – Impact **will be** reversible.* ***0 –** No impact.*
***MAGNITUDE of NEGATIVE IMPACT** (at the indicated spatial scale)*	***10 - Very high**: Bio-physical and/or social functions and/or processes might be severely altered.*
	***8 - High**: Bio-physical and/or social functions and/or processes might be considerably altered.*
	***6 - Medium**: Bio-physical and/or social functions and/or processes might be notably altered.*
	***4 - Low** : Bio-physical and/or social functions and/or processes might be slightly altered.*
	***2 - Very Low**: Bio-physical and/or social functions and/or processes might be negligibly altered.*
	***0 - Zero**: Bio-physical and/or social functions and/or processes will remain unaltered.*
	***10 - Very high (positive)**: Bio-physical and/or social functions and/or processes might be substantially enhanced.*
***MAGNITUDE of POSITIVE IMPACT** (at the indicated spatial scale)*	***8 - High (positive)**: Bio-physical and/or social functions and/or processes might be considerably enhanced.*
	***6 - Medium (positive)**: Bio-physical and/or social functions and/or processes might be notably enhanced.*
	***4 - Low (positive)**: Bio-physical and/or social functions and/or processes might be slightly enhanced.*
	***2 - Very Low (positive)**: Bio-physical and/or social functions and/or processes might be negligibly enhanced.*
	***0 - Zero (positive)**: Bio-physical and/or social functions and/or processes will remain unaltered.*
***PROBABILITY** (of occurrence)*	***5 - Definite**: >95% chance of the potential impact occurring.*
	***4 - High probability**: 75% - 95% chance of the potential impact occurring.*
	***3 - Medium probability**: 25% - 75% chance of the potential impact occurring*
	***2 - Low probability**: 5% - 25% chance of the potential impact occurring.*
	***1 - Improbable**: <5% chance of the potential impact occurring.*
***CUMULATIVE** impacts*	***High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern.* ***Medium**: The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern.*

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	Low: The activity is localised and might have a negligible cumulative impact. *None: No cumulative impact on the environment.*

Once the evaluation components have been ranked for each potential impact, the significance of each potential impact will be assessed (or calculated) using the following formula:

SP (significance points) = (duration + extent + irreplaceable + reversibility + magnitude) x probability

The maximum value is 150 SP (significance points). The unmitigated and mitigated scenarios for each potential environmental impact should be rated as per Table 4 below.

TABLE 4: DEFINITION OF SIGNIFICANCE RATINGS (POSITIVE AND NEGATIVE).

Significance Points	*Environmental Significance*	*Description*
100 – 150	*High (H)*	*An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.*
40 – 99	*Moderate (M)*	*If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.*
<40	*Low (L)*	*An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.*
+	*Positive impact (+)*	*A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.*

Impacts that may result from the planning, design and Construction Phase

*(**Note:** Evaluation components: M – Magnitude; D – Duration; E – Extent; R - Reversibility; I - Irreplaceable; P – Probability; S - Significance)* *Refer to **Section G**, **Table 1:** Evaluation components, ranking scales and descriptions (criteria) and to **Table 2:** Definition of Significance Ratings.*

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RESULTS

DESKTOP STUDY

ELEVATION

Terrain changes drastically from the west (lower lying) to the East (Figure 4). The highest points are in the north-west and south-east of the observations. A general drainage direction is expected from the higher lying areas to the study site.

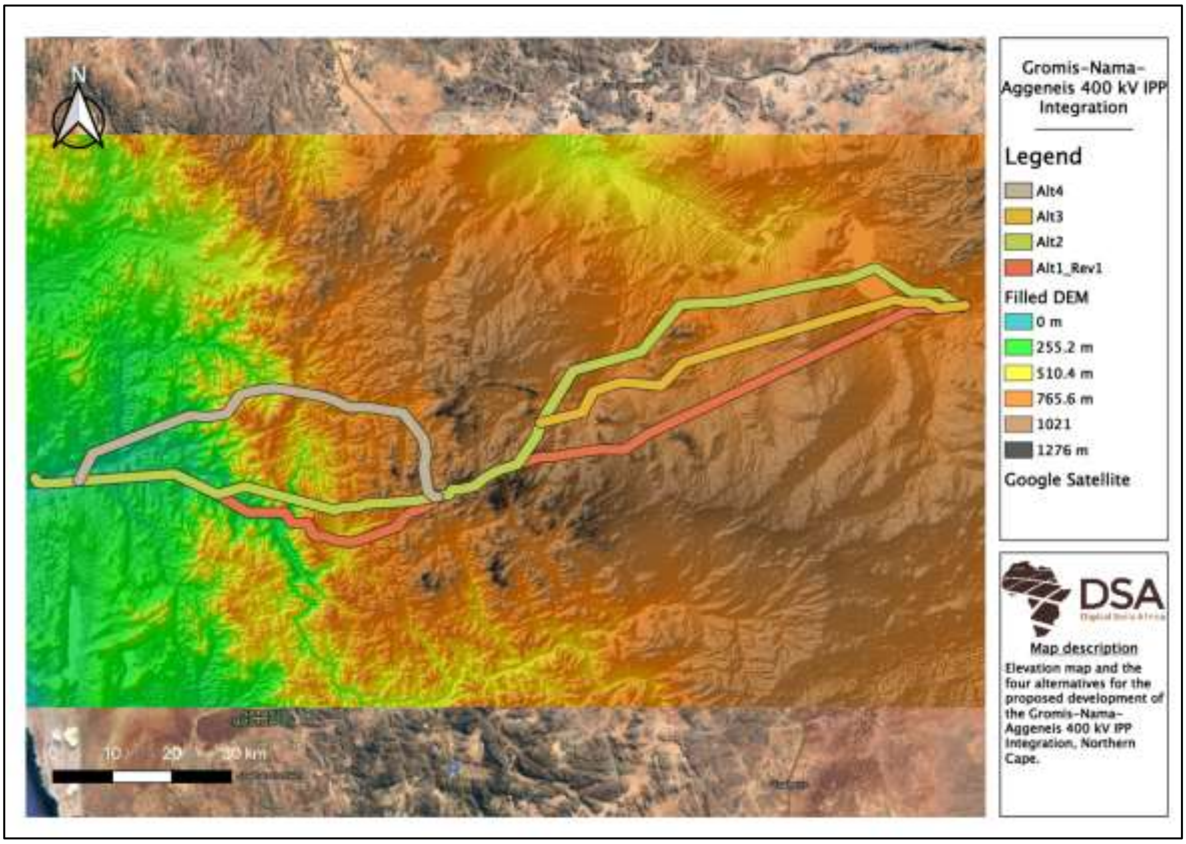

FIGURE 4: ELEVATION OF THE STUDY AREA.

LAND TYPE INFORMATION

The four routes off the IPP encounter the broad landtypes: Ae, Af, Ag, Ah, Fb, Fc, Ib, and Ic landtypes (Figure 5) (Appendix 1).

The criteria for an area to qualify for inclusion in the Ae is that the dominating soils must be **freely drained, and red**, eutrophic, apedal soils comprise of >40% of the land type (yellow soils comprise <10%). The Af is characterized by freely drained, red, eutrophic, apedal soils comprise >40% of the land type (yellow soils comprise <10%); **with dunes**, while Ag has freely drained, shallow **(<300 mm deep)**, red, eutrophic, apedal soils comprise >40% of the land type (yellow soils comprise <10%). The Ah is freely drained, **red and yellow**, eutrophic, apedal soils comprise >40% of the land type (red and yellow soils each comprise >10%)

The Fb is characterised by shallow soils (Mispah & Glenrosa forms) and usually lime lower in the landscape, while Fc is also shallow soils (Mispah & Glenrosa forms); usually lime throughout much of the landscape.

In the Ib landtype, rock outcrops comprise >60% of land type and >80% in in the Ic landtype.

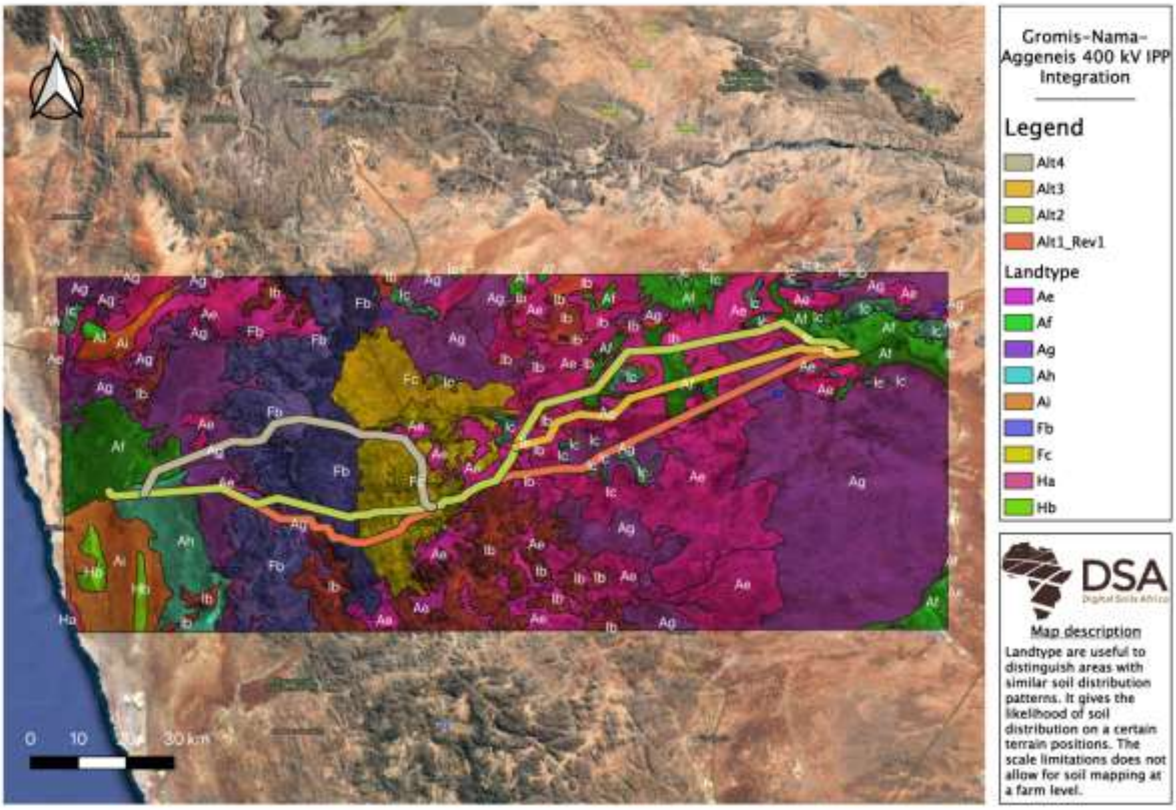

FIGURE 5: LAND TYPES OCCURRING IN THE STUDY AREA (LAND TYPE SURVEY STAFF, 1972 – 2002).

GEOLOGY

The geological map has variations in lithology (Figure 6). The Shales, schist and phyllite of the Nama Group occupy large areas west of Springbok. East of Springbok, Granitic Gneiss of the Namaqualand Metamorphic Complex deposited with Early Tertiary to Recent deposits of older sands.

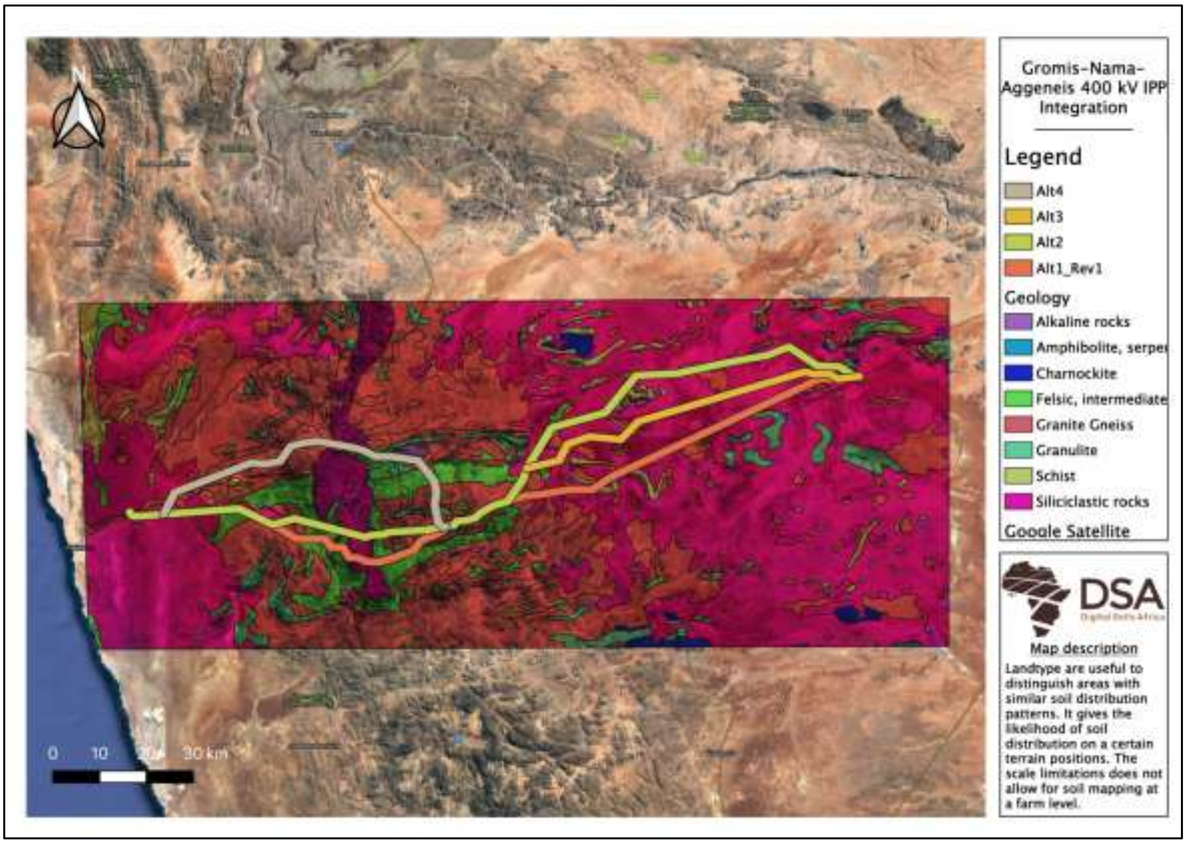

FIGURE 6: GEOLOGY OF THE STUDY AREA.

LAND COVER

The landcover is dominated by classes 10, 31 and 46. These are typically low shrub indigenous karoo-type vegetation. The class definitions and legend of the classes found in the study area are given in Table 5 and the special distribution in Figure 7. Old lands found during the filed visit corelated with the map.

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TABLE 5: NATIONAL LAND-COVER LEGEND AND CLASS DEFINITIONS USED IN THE SOUTH AFRICAN LAND-COVER 2018 DATASET FOUND IN THE STUDY AREA

Band no.	Class Name	Class Definition
2	Contiguous Forest (combined very high, high, medium)	Natural tall woody vegetation communities, with 75% or more canopy cover, and canopy heights ranging between 2.5 - 6 metres. Typically representative of low, indigenous forests and dense thicket communities.
3	Dense Forest & Woodland	Natural tall woody vegetation communities, with canopy cover ranging between 35 - 75%, and canopy he
4	Open Woodland	Natural tall woody vegetation communities, with canopy cover ranging between 10 - 35%, and canopy heights exceeding 2.5 metres. Typically represented by open bush and woodland communities.
10	Low Shrubland (Succulent Karoo)	This is the same as class 8, Low Shrubland, but now represents low, indigenous karoo-type vegetation communities, which have been identified using image-based spectral models, but which fall spatially inside the SANBI defined boundaries for Succulent Karoo vegetation communities.
11	Low Shrubland (Nama Karoo)	This is the same as class 8, Low Shrubland, but now represents low, indigenous karoo-type vegetation communities, which have been identified using image-based spectral models, but which fall spatially inside the SANBI defined boundaries for Nama Karoo vegetation communities.
12	Sparsely Wooded Grassland	Natural woody vegetation, with a woody canopy cover ranging between only 5 - 10%, and canopy heights exceeding 2.5 metres, in a grass-dominated environment. Typically represented by very sparse woodland or lightly wooded grassland communities. This class has been included as it is part of the new gazetted land-cover classification standards, but is challenging to map with 20m resolution imagery, since the associated woody cover component is not a spatially dominant component. Whilst the class has been generated with all possible due care and attention, it must be used and with caution, and should be interpreted as a sub-component of the grassland areas, especially in drier more arid areas.
13	Natural Grassland	Natural and/or semi-natural indigenous grasslands, typically devoid of any significant tree or bush cover, and where the grassland component is typically dominant over any adjacent bare ground exposure. Note this this definition differs slightly from the equivalent gazetted class definition (i.e. total plant canopy cover ranges between 4 - 100%) in order to provide a more comparable content to the 1990 and 2013-14 SANLC datasets. Typically representative of low, grass-dominated vegetation communities in the Grassland and Savanna Biomes.

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21	Artificial Flooded Mine Pits	Man-generated artificial inland waterbodies, specifically associated with flooded mine pits, tai lings ponds, or other surface-based mining activities. The spatial extent of classified water is the cumulative extent of all image-detectable water surfaces from all available images used in the production of the NLC dataset; which is comparable to the annual maximum extent. Note that the occurrence of rooted or floating emergent aquatic vegetation that covers the water surface may influence the area of image-detected open water.
30	Bare Riverbed aterial	Natural or semi-natural, non-vegetated, consolidated or unnaturally occurring coastal sands, typically associated with both coastal dunes and beach environments.
31	Other Bare	Other natural, semi-natural or man-created non-vegetated areas. Typically associated with permanent or near permanent bare ground sites that have insufficient spatial or temporal characteristics to be otherwise classified.
32	Cultivated Commercial Permanent Orchards	Active or recently active cultivated lands used for the production of agricultural crops, in this case specifically associated with commercial orchards consisting of tree and/or bush based plants. Plants remain in-field for multiple growing seasons and harvests. Often irrigated.
40	Cultivated Commercial Annuals Non-Pivot / Non-Irrigated	Active or recently active cultivated lands used for the production of agricultural crops, in this case specifically associated with commercial annual crops, The plants only remain in the field for one growing seasons and one harvest, and are grown non-irrigated, rainfed fields.
44	Fallow Land & Old Fields (Grass)	Long-term, non-active, previously cultivated lands that are now overgrown with grass dominated woody vegetation. Typically the cultivated land unit is no longer image detectable. Historical field boundaries (supplied by SANBI) have been mapped from archival topographical 1:50,000 maps circa 1950's-70's. This class is only represented if it has not been modified to a more recent, alternative land-cover or land-use class.
45	Fallow Land & Old Fields (Bare)	Long-term, non-active, previously cultivated lands that are now predominately non-vegetated bare ground surfaces. Typically the cultivated land unit is no longer image detectable. Historical field boundaries (supplied by SANBI) have been mapped from archival topographical 1:50,000 maps circa 1950's-70's. This class is only represented if it has not been modified to a more recent, alternative land-cover or land-use class.
46	Fallow Land & Old Fields (low shrub)	Long-term, non-active, previously cultivated lands that are now overgrown with tree-dominated low shrub vegetation. Typically the cultivated land unit is no longer image detectable. Historical field boundaries (supplied by SANBI) have been mapped from archival topographical 1:50,000 maps circa 1950's-

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		70's. This class is only represented if it has not been modified to a more recent, alternative land-cover or land-use class.
55	Village Scattered	Built-up areas primarily associated with scattered rural settlements and associated utilities. It may include some adjacent areas of subsistence farming, especially if the village structures and fields are inter-mixed. This class is also associated with both structures on individual (commercial or smallholding) farming units, depending on clustering and size. Scattered villages are defined as those represented by contiguous / adjacent village-classified cells which collectively do not form the majority cover in a surrounding 1 ha window. Note that the class extent includes both bare / non-vegetated and low vegetation covered areas within the village boundary. Woody cover is excluded from this class and represented separately (i.e. classes 2 – 4).
56	Village Dense	Built-up areas primarily associated with scattered rural settlements and associated utilities. It may include some adjacent areas of subsistence farming, especially if the village structures and fields are inter-mixed. This class is also associated with both structures on individual (commercial or smallholding) farming units, depending on clustering and size. Dense villages are defined as those represented by contiguous / adjacent village-classified cells which collectively do form the majority cover in a surrounding 1 ha window. Woody cover is excluded from this class and represented separately (i.e. classes 2 – 4).
62	Urban Recreational Fields (Bush)	Non-built-up, vegetated urban areas primarily associated with formally planned and established parks, sports fields, and golf courses. Any built-up structures within the environment are classified separately as appropriate. The vegetation cover is primarily bush-based.
63	Urban Recreational Fields (Grass)	Non-built-up, vegetated urban areas primarily associated with formally planned and established parks, sports fields, and golf courses. Any built-up structures within the environment are classified separately as appropriate. The vegetation cover is primarily low-shrub or grass-based.
66	Industrial	Built-up areas primarily containing formally planned and constructed industrial structures and associated utilities. Includes both light and heavy industry, power generation, airports, rail terminals and ports. In the agricultural sector this class also represents (chicken and pig) animal batteries, greenhouses and tunnels and intensive feedlots
68	Mines: Surface Infrastructure	Built-up structures associated with the administration and/or industrial processing and extraction of mined resources. This class may be associated with either surface or sub-surface mining activities.
69	Mines: Extraction Sites:	Non-vegetated, active and/or non-active extraction pits associated with surface-based mining activities, including open-cast mines, quarries, and

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	Open Cast & Quarries combined	road-side borrow pits etc. Note that in some cases (especially coal mining) there may be some overlap/mis-representation between mine-extraction pits and mine-tailings, due to the challenge of separating these accurately.

FIGURE 7: SOUTH AFRICAN NATIONAL LAND COVER (SANLC) 2018 LAND COVER OF THE STUDY AREA.

SOIL SURVEY

The soil map (Figure 8) is dominated by deep soils and shallow leptosols. The deep soils consist of Hutton, Clovelly and Oakleaf soils, while the leptosols consist of Mispah, Glenrosa, Hutton soils (Table 6).

FIGURE 8: SOIL MAP OF THE STUDY AREA.

TABLE 6: THE SOIL TYPES FOUND IN THE STUDY AREA.

Map Code	Map unit	Description	Soil Forms (Red book)
1	Deep	Deeper than 1200 mm depth, apedal structure	Hutton, Clovelly, Oakleaf
2	Dundee	Dundee soil form	Dundee
3	Lepto	Shallower than 500mm, apedal structure	Mispah, Glenrosa, Hutton
4	Moderate	Moderate depth, between 500 and 1200 mm, apedal structure	Hutton, Clovelly, Oakleaf
5	Pedo	Soils with pedo- or prismacutanic B horizon	Valsrivier, Swartland, Sterkspruit

SOIL CHEMISTRY

Representative soil samples for the area were analysed and selected soil properties are found in Table 7 and the texture results in Table 8. More comprehensive soil chemical results are found in Appendix 2. The results indicate that the soils are generally sandy with the typical chemical values for sandy soils in arid climates. The pH is slightly acid to neutral. The very low EC is an indication that there is no build-up of salinity in the soils.

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TABLE 7: SELECTED SOIL CHEMICAL PROPERTIES OF REPRESENTATIVE SAMPLES

Sample	pH	CEC	ESP	ECe
	KCl	cmol(+)/kg	%	mS/m
KB 1A	6.96	4.64	3.91	4.65
KB 1B	6.99	5.36	3.05	9.05
KB 6A	6.79	4.56	8.71	8.86
KB 6B	6.70	1.52	6.56	11.07

TABLE 8: TEXTURE OF REPRESENTATIVE SAMPLES

Field number	% clay	% Silt	% Sand
ASG 1A	19.4	10.2	71.1
ASG 1B	9.4	4.2	87.1
ASG 2A	5.8	3.6	90.8
ASG 2B	6.2	3.0	90.9

LAND CLASS SENSITIVITY

The area has a very low rating, with some existing agricultural lands in the more mountainous terrain (Figure 9). Since there is very little crop production in the area, the lines should be re-routing onto lower sensitivity agricultural land to preserve the current agricultural production.

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FIGURE 9: SENSITIVITY RATING AND THE ROUTES INVESTIGATED.

IDENTIFIED IMPACTS

Impacts from Agriculture Scoping Assessment Report in the Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa (CSIR, 2016):

- *Loss of agricultural land use, caused by direct occupation of land by footprint of power line infrastructure This takes affected portions of land out of agricultural production;*
- *Loss of agricultural land use due to fragmentation of agricultural land. EGI infrastructure can lead to the division of fields and isolation of portions of them into non-viably small areas for cultivation. Such fragmentation leads to an effective additional loss of agricultural land over and above that lost to the direct footprint;*
- *Limitation to the existence of plantation trees, wind break trees and tall crop trees under power lines due to height restrictions. Exclusion of wind breaks has the effect of reducing the environmental suitability and therefore agricultural potential of affected land for horticultural crops.*
- *Disturbance to crop spraying by aircraft over land occupied by power lines.*
- *Soil Erosion caused by alteration of run-off characteristics due to vegetation removal and surface disturbance and compaction, particularly on access roads and construction*

camps. The disturbance of existing contour banks and drainage systems used for erosion control, by construction activities on or near them, can also cause erosion. Erosion causes loss and deterioration of soil resources;

- *Degradation of vegetation beyond the direct footprint due to constructional disturbance, dust and vehicle trampling;*
- *Loss of topsoil due to poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, road surfacing etc.) and resultant decrease in that soil's capability to support plant growth;*
- *Disturbance to agricultural practices and management during construction;*

List of impacts identified during fieldwork

- The presence of freely drained soils poses a risk of contaminating the groundwater through the following activities:
    - Pit latrines
    - Incorrect disposal of hazardous substances
    - Workshop and equipment maintenance
    - Batching plants
    - Stockpiling
- The presence of shallow soils on steep slopes, contaminants discharged have a high risk of contaminating streams and therefore the following activities would need to be avoided:
    - Incorrect disposal of hazardous substances
    - Workshop and equipment maintenance
    - Batching plants
    - Stockpiling

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MITIGATION MEASURES FOR IDENTIFIED IMPACTS

Relevant mitigation from the following sources:

- *GENERIC ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr) FOR THE DEVELOPMENT AND EXPANSION OF INFRASTRUCTURE FOR THE OVERHEAD TRANSMISSION AND DISTRIBUTION OF ELECTRICITY*
  - Plan the fine-scale positioning of pylons, access roads and construction camps to have minimal disturbance on agricultural activities and agricultural land. Pylons should be positioned on existing boundaries or edges of agricultural units of land wherever possible, so as not to interfere with agricultural activities within a unit;
  - Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion. Soil surface stabilising measures must be used if necessary, on all areas that are highly susceptible to erosion. Plan the fine-scale positioning of pylons, access roads and construction camps to avoid land that has contour banks. If any contour banks are disturbed, fully restore their integrity and that of the run-off system of which they are a part, after disturbance. The effectiveness of the run-off control system and the occurrence of any erosion on site or downstream must be monitored. Corrective action must be implemented to the run-off control system in the event of any erosion occurring;
  - Restrict all vehicle traffic within the footprint of disturbance and control dust during construction; If an activity will mechanically disturb below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Erosion must be controlled where necessary on newly top soiled areas, which are likely to be susceptible to erosion;

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IMPACT RATING RESULTS

The impact ratings are the same for all the routes as most the area is classified as having a low sensitivity rating.

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT		ENVIRONMENTAL SIGNIFICANCE																		MITIGATION
			BEFORE MITIGATION									AFTER MITIGATION									
		Homogenous area identifier	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	
	Potential Impacts on geographical and physical aspects																				
Project activity:	Planning and design																				
Alternative 1&2&5	*Loss of agricultural land use, caused by direct occupation of land by footprint of power line infrastructure*	Sensitivity class medium Figure 9	4	5	1	1	1	2	24	L	L	2	1	1	1	1	2	12	L	L	Avoid current cropped land, impact on grazing will be minimal.
Alternative 1&2&5	*Loss of agricultural land use due to fragmentation of agricultural land.*	Sensitivity class medium Figure 9	4	5	1	1	1	2	24	L	L	2	1	1	1	1	2	12	L	L	Cropped lands are already fragmented, therefore can be avoided.
Alternative 1&2&5	*Disturbance to crop spraying by aircraft over land occupied by power lines*	Sensitivity class medium Figure 9	6	5	1	2	1	2	30	L	L	2	1	1	1	1	2	12	L	L	Limited cropped lands do not justify crop spraying.

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT		ENVIRONMENTAL SIGNIFICANCE																		MITIGATION
			BEFORE MITIGATION									AFTER MITIGATION									
		Homogenous area identifier	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	
Alternative 1&2&5	*Soil Erosion caused by alteration of run-off characteristics due to vegetation removal and surface disturbance and compaction, particularly on access roads and construction camps.*	Entire area	8	5	2	3	3	3	63	M	M	4	2	2	2	3	2	26	L	L	Control runoff and reduce areas were water accumulates at high velocity
Alternative 1&2&5	*Loss of topsoil due to poor topsoil management*	Entire area	8	3	1	3	2	3	51	M	M	6	1	1	2	3	2	26	L	L	Topsoil stripping and stockpiled for rehabilitation
Alternative 1&2&5	*Groundwater contamination*	Deep soil Figure 8	8	5	3	4	4	2	48	M	M	2	1	1	2	3	2	18	L	L	Good waste management practices

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PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT		ENVIRONMENTAL SIGNIFICANCE																		MITIGATION
			BEFORE MITIGATION									AFTER MITIGATION									
		Homogenous area identifier	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	
Alternative 1&2&5	*Stream contamination*	Leptosols in mountainous areas Figure 8	8	5	3	4	4	2	48	M	M	2	1	1	2	3	2	18	L	L	Good waste management practices

COMPARISON OF ALTERNATIVES AND PREFERRED ALTERNATIVE RECOMMENDATION

Since climate is the major control of agricultural potential in this area, most the areas are classified as low sensitivity. Therefore, powerlines will not have a significant effect. The use of the existing road network for the current line would decrease the risks of erosion associated with road building and, therefore, Alternative 1 would be the preferred route.

RECOMMENDED 'NO-GO AREAS'

No highly sensitive areas were surveyed in the study. There are very few cropped land and no irrigation was encountered.

SUMMARY OF RECOMMENDED MITIGATION MEASURES

The highest risks are associated with construction. Therefore, runoff control and safely disseminates run-off water from all hardened surfaces is very important. The proper rehabilitation of construction sites post construction.

FINAL SPECIALIST RECOMMENDATIONS

Although the presence of powerlines will not heavily affect the agricultural potential of any of the routes, the use of existing roads will be most beneficial. Therefore, it is recommended that the route follow the existing line (Atlernative 1). Since Alternative 5 very closely mimics Alternative 1, it would also be a viable option.

CONCLUSION

Due to the low rainfall and high temperatures, the agricultural potential is severely impacted and limited by climate. Cropped lands are sparsely distributed in the more mountainous areas, and the flats are solely used for grazing. Even were crops are grown, these would be considered marginal areas and low yields are expected. No irrigation or special crops were encountered during the fieldwork, which correlates with the latest Landuse maps.

Therefore, all routes are suitable for the development of a new power line from Gromis substation via Nama substation towards Aggeneis substation. Although the use of existing road networks for the current line would have the least impact and avoid some minor risks of erosion during construction.

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APPENDIX 1: LANDTYPE

LAND TYPE / *LANDTIPE* .... : **Ae37**
CLIMATE ZONE / *KLIMAATSONE* .... : 12S
Area / *Oppervlakte* .... : 148660 ha
Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 4200 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :
2724 Christiana (142200 ha) 2726 Kroonstad (6460 ha)

Inventory by / *Inventaris deur* :
R W Bruce & J L Schoeman

Model Profiles / *Modale profiele* :
P162 P165

Terrain unit / *Terreineenheid* .... :	4	5
% of land type / % *van landtipe* .... :	90	10
Area / *Oppervlakte (ha)* .... :	133794	14866
Slope / *Helling (%)* .... :	0 - 2	0 - 1
Slope length / *Hellingslengte (m)* .... :	1000 - 2000	50 - 500
Slope shape / *Hellingvorm* .... :	Z-Y	Z-X
MB0, MB1 (ha) .... :	85628	11893
MB2 - MB4 (ha) .... :	48166	2973

Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** (mm)	MB	ha	%	ha	%	**Total** / ***Totaal*** ha	%	**Clay content %** / ***Klei-inhoud %*** A	E	B21	Hor	**Texture** / ***Tekstuur*** Class / *Klas*	**Depth limiting material** / ***Diepte-beperkende materiaal***
Soil-rock complex / *Grond-rotskompleks:*														
Rock/Rots		4	18731	14	2825	19	21556	14.5						
Loskop Ms12, Kalkbank Ms22, Mispah Ms10	100-200	3	25421	19	149	1	25570	17.2	6-20			A	fiSa-SaLm	ka,R
Williamson Gs16, Kanonkop Gs13, Trevanian Gs17	150-250	3	4014	3			4014	2.7	10-20			A	LmfiSa-SaLm	R,so
Shorrocks Hu36	300-400	0	36124	27			36124	24.3	8-15		15-25	B	fiSaLm-SaClLm	R,so
Blinkklip Cv36, Dudfield Cv46	350-450	0	14717	11			14717	9.9	7-15		15-25	B	fiSaLm-SaClLm	R,ka,so
Sterkspruit Ss26, Swaerskloof Ss16, Stanford Ss23, Hartbees Ss24	75-125	0	10704	8	1487	10	12190	8.2	10-20		30-35	A	LmfiSa-SaLm	B2
Rensburg Rg20	600-800	0			5946	40	5946	4.0	50-60			A	Cl	G
Limpopo Oa46	850-950	0	2676	2	1487	10	4162	2.8	10-15		15-25	B	fiSaLm-SaClLm	ka,R
Mangano Hu33, Zwartfontein Hu34	300-400	0	4014	3			4014	2.7	6-10		12-15	B	LmfiSa	R,so
Rietvlei We12, Sibasa We13, Devon We22	450-550	0	4014	3			4014	2.7	15-25		30-40	A	fiSaLm-SaClLm	B2gc
Gelykvlakte Ar20	550-650	0	2676	2	743	5	3419	2.3	45-60			A	Cl	R,so
Lindley Va41, Valsrivier Va40	150-250	0	2676	2	743	5	3419	2.3	15-20		30-40	B	fiSaClLm-SaCl	B2
Soetmelk Av36	550-650	0	2676	2			2676	1.8	8-15		15-25	B	fiSaLm-SaClLm	B2gc
Kinross Sd20, Glendale Sd21, Sunvalley Sd31	550-650	0	2676	2			2676	1.8	15-20		30-40	B	fiSaClLm-SaCl	so
Killarney Ka20	250-350	0			1487	10	1487	1.0	15-20			A	fiSaLm	G
Annandale Cv33, Leslie Gc36, Makuya Cv34	350-450	0	1338	1			1338	0.9	6-15		12-20	B	LmfiSa-SaLm	R,hp,so

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LAND TYPE / *LANDTIPE* .... : Bd9
CLIMATE ZONE / *KLIMAATSONE* .... : 12S
Area / *Oppervlakte* .... : 191250 ha
Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 4000 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :
2624 Vryburg (80890 ha) 2724 Christiana (110360 ha)

Inventory by / *Inventaris deur* :
R W Bruce & J L Schoeman

Modal Profiles / *Modale profiele* :
P122 P123 P163

Terrain unit / *Terreineenheid*	4	4(1)	5
% of land type / *% van landtipe*	80	11	9
Area / *Oppervlakte (ha)*	153000	21038	17212
Slope / *Helling (%)*	0 - 2	1 - 2	0 - 1
Slope length / *Hellingslengte (m)*	800 - 1200	150 - 250	40 - 60
Slope shape / *Hellingsvorm*	Z-Y	Z-Y	Z-X
MB0, MB1 (ha)	153000	15357	13426
MB2 - MB4 (ha)	0	5680	3787

Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte*** (mm)	MB	ha	%	ha	%	ha	%	**Total** / ***Totaal*** ha	%	**Clay content %** / ***Klei-inhoud %*** A	E	B21	Hor	**Texture** / ***Tekstuur*** Class / *Klas*	**Depth limiting material** / ***Diepte-beperkende materiaal***
Soil-rock complex																
Grond-rotskompleks:																
Rock/Rots		4			1893	9	1893	11	3787	2.0						
Loskop Ms12, Kalkbank Ms22	100-200	3			3787	18	1893	11	5680	3.0	12-20			A	LmfiSa-SaLm	ka
Soetmelk Av36	950-1200+	0	36720	24					36720	19.2	10-20		15-25	B	fiSaLm-SaClLm	B2gc
Shorrocks Hu36	950-1200+	0	29070	19					29070	15.2	10-15		15-25	B	fiSaLm-SaClLm	R,so
Bainsvlei Bv36	950-1200+	0	19890	13					19890	10.4	10-15		15-25	B	fiSaLm-SaClLm	B2gc
Blinkklip Cv36	>1200	0	16830	11					16830	8.8	10-15		15-25	B	fiSaLm-SaClLm	R,so
Rietvlei We12, Devon We22, Sibasa We13	450-550	0	15300	10					15300	8.0	15-25		30-40	B	fiSaCl-ClLm	B2gc
Sterkspruit Ss26, Stanford Ss23, Hartbees Ss24	200-300	0			9467	45	1893	11	11360	5.9	10-20		25-35	A	LmfiSa-SaLm	B2
Zwartfontein Hu34	950-1200+	0	10710	7					10710	5.6	8-12		10-15	B	LmmeSa-SaLm	R,so
Rensburg Rg20, Killarney Ka20, Sarasdale Wo20	400-800	0					9639	56	9639	5.0	35-60			A	fiSaCl-Cl	G
Lindley Va41, Arniston Va31, Valsrivier Va40	250-350	0			5891	28	1893	11	7784	4.1	15-30		30-40	B	fiSaClLm-ClLm	B2
Heidelberg Av34	950-1200+	0	7650	5					7650	4.0	8-12		10-15	B	LmmeSa-SaLm	B2gc
Annandale Cv33	>1200	0	7650	5					7650	4.0	6-12		10-15	B	LmfiSa-SaLm	R,so
Leslie Gc36	800-1000	0	4590	3					4590	2.4	10-15		15-25	B	fiSaLm-SaClLm	hp
Denhere Cv35	>1200	0	3060	2					3060	1.6	6-12		10-15	B	LmcoSa-SaLm	R,so
Portsmouth Hu35	950-1200+	0	1530	1					1530	0.8	6-12		10-15	B	LmcoSa-SaLm	R,so

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APPENDIX 2: SOIL CHEMICAL PROPERTIES

Obs and horizon	Lab nr	Ca				Mg				Na			
		mg/l	mg/kg	me/kg	cmol(+)/kg	mg/l	mg/kg	me/kg	cmol(+)/kg	mg/l	mg/kg	me/kg	cmol(+)/kg
ASG 1A	1218	28.02	560.48	28.02	2.80	6.56	131.24	10.76	1.08	3.50	70.08	3.05	0.30
ASG 1B	1219	36.08	721.56	36.08	3.61	8.00	160.02	13.12	1.31	2.41	48.18	2.09	0.21
ASG 2A	1220	33.49	669.76	33.49	3.35	4.83	96.56	7.91	0.79	1.60	32.02	1.39	0.14
ASG 2B	1221	7.25	144.98	7.25	0.72	3.80	76.08	6.24	0.62	1.52	30.46	1.32	0.13

Lab nr	K				SO4		S	P Bray 1		pH KCl	US.KCl
	mg/l	mg/kg	me/kg	cmol(+)/kg	mg/l	0.202	mg/kg	mg/l	mg/kg		
ASG 1A	8.99	179.82	4.61	0.46	1.18	0.39	7.85	2.827	56.54	6.96	0
ASG 1B	4.50	89.92	2.31	0.23	1.14	0.38	7.62	2.81	56.20	6.99	0
ASG 2A	5.46	109.10	2.80	0.28	0.69	0.23	4.61	0.88	17.64	6.79	0
ASG 2B	0.77	15.46	0.40	0.04	0.20	0.07	1.34	0.36	7.14	6.70	0

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Lab nr	Suur versadeging %	Ca:Mg	Mg:K	(Ca+Mg)/K	%Ca/BK	%Mg/BK	%Na/BK	%K/BK	Basiese katione	KUK
									cmol(+)/kg	cmol(+)/kg
ASG 1A	0.00	2.75	5.70	21.39	67.32	24.48	3.91	4.29	5.36	5.36
ASG 1B	0.00	4.23	2.84	14.84	73.46	17.36	3.05	6.12	4.56	4.56
ASG 2A	0.00	1.16	15.77	34.11	47.68	41.01	8.71	2.60	1.52	1.52
ASG 2B	0.00	2.61	2.34	8.43	60.36	23.17	6.56	9.91	4.64	4.64

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APPENDIX 3: AGRICULTURAL SENSITIVITY: SCREENING TOOL

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Alternate 2

Alternate 4

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APPENDIX 4: OBSERVATIONS

X	Y	Obs	Name
18.63858992	-29.38543146	1	Cv 500
18.63083885	-29.3800139	2	Cv 600
18.7322245	-29.33342667	3	Hu 500
18.62556737	-29.36664715	4	Hu 600
18.80619433	-29.29969753	5	Hu 1000+
18.78678487	-29.31060155	6	Hu 1200+
18.61927803	-29.26832908	7	Hu 1200+ Sampled
18.61792126	-29.34914396	8	Ms 300
18.6111878	-29.33463317	9	Ms 300
18.61718715	-29.29130856	10	Ms 400
18.00058643	-29.55545419	11	Cv 800
18.25750381	-29.52873675	12	Gs 1000
18.16167522	-29.55104813	13	Hu 600
18.23645696	-29.53689871	14	Hu 600 Lithic
18.08611223	-29.57119554	15	Hu 700
18.14297102	-29.55178624	16	Hu 700
18.0639983	-29.49521232	17	Hu 800
18.09396522	-29.48098184	18	Hu 1000
18.03367157	-29.52314268	19	Hu 1000 Lithic
18.01059747	-29.54768343	20	Hu 1000+
18.0331325	-29.51974791	21	Hu 3500 Sample 1
18.06561224	-29.56369295	22	Ms 300
18.0217613	-29.57669616	23	Ms 400

18.26839084	-29.5205074	24	Ms 400
18.0696616	-29.45735688	25	Or 400lithic
18.20552607	-29.55100658	26	Ot 400 Lithic
18.09544615	-29.56110778	27	Ot 400 On Lithic
18.06541281	-29.56139311	28	Sand Dune
17.75630278	-29.71241389	38	Ms
17.82214444	-29.62005556	39	Gs 700
17.86514167	-29.58161389	40	Cv 2000+
17.86305	-29.58217222	41	Cv 2000+
17.69951944	-29.44690556	42	Rock
17.68290833	-29.43359167	43	Ms
17.67587222	-29.42178611	44	Ms
17.615825	-29.48130833	45	Ms
17.583275	-29.56455556	46	Ms
17.6248	-29.56285278	47	Ms
17.65223333	-29.55255833	48	Ms
17.41190833	-29.60046111	50	Hu 600 Lithic
17.405775	-29.55641111	51	Ye 2000+
17.53706111	-29.623975	52	Ye 300
18.0325438	-29.52367683	54	Hu 1000 lithic
TY		55	hu 600
18.08979444	-29.42615833	56	hu 800
18.62015556	-29.39298333	57	hu 600
18.73903611	-29.33537778	58	red dunes
18.73898889	-29.33538333	59	ms 400

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17.18086198	-29.60657219	70	3500+ Red
17.2317878	-29.59913768	71	Ye 3500+
17.31345017	-29.55975617	72	Hu 5000+
17.64997662	-29.4230705	73	Cv 600
17.74310583	-29.69901871	74	Ms
17.72989667	-29.69514705	75	Ms
17.71422028	-29.6951091	76	Ms
17.77849708	-29.7082769	77	Ms
17.7666326	-29.70737316	78	Ms
17.81694312	-29.68262129	79	Ms
17.81171662	-29.66826418	80	Ms
17.81119846	-29.65696937	81	Ms
17.81099167	-29.63321489	82	Ms
17.88153452	-29.63353071	83	Hu 700
17.83505441	-29.4709983	84	Hu 600